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The revolution in military affairs and the politics of innovation in the U.S. Navy

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THE REVOLUTION IN MILITARY AFFAIRS AND THE POLITICS OF INNOVATION IN THE U.S. NAVY

by

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December, 1994

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This thesis examines past theories of military and naval innovation in an effort to draw lessons from which today's naval leaders can foster innovation in the United States Navy. There is a natural tendancy to resist change, unless it is disguised as doing the same thing better. Understanding the process can help encourage innovation advocates, or zealots as they are often called, who are necessary for true change.

In this period immediately following the Cold War, there is uncertainty over future roles and missions, because our primary adversary has diminished in power. Yet, the United States Navy has embraced a revolutionary strategy, causing the maritime forces to look to shoreward, instead of seaward.

It is too early to tell if the new strategy and the accompanying doctrine (not yet published) will be successful. However, there are signals one can look for to see if the Navy is committing its resources to support its announced shift in focus. Old combat arms will be disrupted, or eliminated. A new career path should emerge in which the best and brightest junior officers stake their future.

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THE REVOLUTION IN MILITARY AFFAIRS AND THE POLITICS OF INNOVATION IN THE U.S. NAVY

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Submitted in partial fulfillment
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ABSTRACT

This thesis examines past theories of military and naval innovation in an effort to draw lessons from which today's naval leaders can foster innovation in the United States Navy. There is a natural tendancy to resist change, unless it is disguised as doing the same thing better. Understanding the process can help encourage innovation advocates, or zealots as they are often called, who are necessary for true change.

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Executive Summary

Naval warfare has changed dramatically from the days of wooden ships to the high-tech force of the modern United States Navy. Some of the changes occurred through incremental or evolutionary processes, but other changes have been revolutionary.

In this period immediately following the Cold War, there is uncertainty over future roles and missions in the U.S. Armed Forces, because our principal rival has diminished in power. Yet, the United States Navy has embraced a revolutionary strategy in which the maritime forces look to shoreward instead of seaward.

In peacetime, tremendous opportunities exist for militaries to innovate and plan for future wars while free of imminent threats. During this period of change and and potential innovation it is useful to examine similar periods in history for lessons that will suggest how innovation may be successfully accomplished today. Many successful innovations described in the literature occurred during periods of peace and constrained resources, much as the Navy finds itself today.

Numerous models exist that seek to explain how military innovation occurs, but no single model explains all cases of innovation. Three models are presented as differing views of how military innovation occurs. First, Vincent Davis showed that innovation usually begins with a mid-grade officer who finds a better way of doing something. Next, Ronald Kurth reported that there are many institutional constraints on innovation in the Navy, but not on efficiency improvements. To enact a major innovation, a maverick zealot is necessary. Finally, Steven Peter Rosen offered multiple models for different conditions. In peacetime, innovation occurs because military men construct a vision of

what the next war will be like, and how innovations will be effective in winning it. Then they take the necessary steps to accomplish it. Rosen also concluded that technological innovation is a special case. He said technological innovation occurred primarily to manage uncertainty. When military officers are faced with uncertain conditions, they turn to sources outside the military to provide solutions.

Military innovation is being driven and encouraged by many of today's civilian and military leaders, but although guidance and direction are being provided from the top, the outcome is uncertain. Innovations undertaken, or not undertaken, and the success of such innovations during this period of relative peace will affect the Navy's role in future conflicts, and may shape future conflict itself.

The innovation process can be enhanced by a better understanding of the politics involved. Military organizations seem willing to innovate so long as it does not disrupt anything, but true innovation is almost certain to be disruptive.

Since the end of the Cold War, the U.S. Navy has embraced a revolutionary strategy. It is too early to tell whether the innovation in strategy will result in a revolutionary doctrine. No other changes undertaken in the last several years are seen as truly revolutionary, however, there are innovations being contemplated such as, unmanned aircraft taking over some manned-aircraft missions, which could have as broad impact as the Navy's decision to integrate aviation before World War II.

If the Navy's current littoral focus proves to be more than a passing trend, the Navy must focus resources, and ensure a viable career path exists for junior officers to succeed in the new field of littoral warfare.

The current Revolution in Military Affairs envisions battle environment with near real-time, near-perfect knowledge available to commanders; perhaps a new generation

of cheap, smart, stealthy missiles e.g., "Super Tomahawks" that will do shore bombardment better and more cheaply than aircraft; and wings of stealth aircraft protecting fleets and ground forces.

Will the RMA succeed? As with all innovation, success or failure depends on the emergence of advocates or zealots who will push their innovation in the face of huge opposition.

I. INTRODUCTION

Peace has been declared. . . . What a fix we are in now!

N. Bonaparte(1802)

The last decade has been a tumultuous one for the United States armed forces. A decade ago, America was building up its military, and equipping it with the most advanced and modern hardware that the world has ever seen. Simultaneously, U.S. military forces achieved unprecedented levels of education, training and competency. At, or near, the peak of that buildup America's principal rival, the Soviet Union collapsed.

With the shriveling of the Soviet Empire and the loss of the United States' principal potential adversary, the U.S. military is now downsizing, transforming, and thinking through the new roles it may play in the post-Cold War era. In the 1991 Gulf War, the first major post-Cold War military engagement involving U.S. troops, the public got a glimpse of the power of American military forces equipped with modern weaponry. It was the world's first exposure to what some are calling a military-technological revolution (MTR), or a revolution in military affairs (RMA), that is, a revolution in the way the U.S. military employs forces and wages combat.

It is in this environment of downsizing and transformation, while perched at the brink of a revolution in military technology and its application, that the U.S. Navy finds itself today. In recent years the Navy has taken specific steps to meet the challenges of this new environment. It has shifted from the open-ocean naval strategy expressed in the 1986 document, *The Maritime Strategy*, to a littoral focus explained recently in the Navy white paper, . . .*From the Sea*. The Navy has also begun development of a formal written doctrine, under the aegis of

a newly-formed Naval Doctrine Command, to pair with its new strategy.

As the U.S. military's budget declines, the Navy's leaders are challenging naval personnel to innovate. In a speech delivered in April 1994 to open the Current Strategy Forum, Secretary of the Navy, Dalton used the words "innovative" and "innovation" 32 times.[1] These events, while not fully integrated, signal tremendous change for the Navy, and raise many questions concerning the Navy's future.

In peacetime, tremendous opportunities exist for militaries to innovate and plan for future wars while free of imminent threats. During this period of change and innovation it is useful to examine similar periods in history for lessons that will suggest how innovation may be successfully accomplished. The purpose of this paper is to present ideas by which today's naval leaders might benefit from lessons previously examined by other authors of military or naval innovation.

Several contemporary authors have written about the politics of innovating within the Navy. More than twenty years ago, Vincent Davis,[2] and retired U.S. Navy Rear Admiral Ronald Kurth,[3] wrote about innovations undertaken in the Navy during the World Wars and the early Cold War years (up to the 1960s). Using several U.S. Navy and Marine Corps' innovations as examples, Steven Peter Rosen laid down precepts for successful military innovations in his 1988

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[1]John W. Mashek, "Navy strategy session in R.I. uneasy with Clinton policies," Boston Globe, 17 June 1994, p. 20, cited in Bradd C. Hayes, and Douglas V. Smith, eds., The Politics of Naval Innovation, Strategic Research Department Research Report 4-94, (Newport: U.S. Naval War College, 1994), p. 101.

[2]Vincent Davis. The Politics of Innovation: Patterns in Navy Cases, Monograph Series in World Affairs, Vol. 4, No. 3 (Denver: University of Denver, 1967).

[3]Ronald James Kurth, "The Politics of Technological Innovation in the United States Navy," doctoral thesis (Cambridge, MA: Harvard University, June 1970).

article, "New Ways of War."[4] Rosen later expanded this work to several distinct types of military innovations in a 1991 book, Innovation and the Modern Military: Winning the Next War.[5] More recently, U.S. Naval Reserve Captain Philip W. Signor wrote about the successful introduction of cruise missiles into the Navy.[6] And in 1994, the Naval War College published a series of papers addressing the politics of naval innovation.[7]

Using case studies these authors described the difficulty in implementing truly revolutionary innovations. All agree that making evolutionary changes by improving efficiency is far easier than implementing truly innovative or revolutionary change, especially when new equipment is required. Many successful innovations described in the literature occurred in peacetime when budgets were tight, as is the case in the Navy today. With that in mind a number of questions arise.

- Do the changes taking place in the U.S. Navy today qualify as innovations, or are they merely methods of making the Navy more efficient and better able to accomplish existing missions?

- Most authors on military innovation concluded that great technological innovation does not automatically translate into success in battle for the innovator's armed forces. What can and should the United States Navy be doing now to ensure that today's innovations succeed? How can the

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[4]Steven P. Rosen, "New Ways of War: Understanding Military Innovation," International Studies, 13 (Summer 1988): 134-168.

[5]Steven P. Rosen, Winning the Next War: Innovation and the Modern Military, (Ithaca, NY: Cornell University Press, 1991).

[6]Philip W. Signor, "Cruise Missiles for the U.S. Navy: An Exemplar of Innovation in a Military Organization," (Newport: U.S. Naval War College, 1994).

[7]See Hayes and Smith in note 1 above.

Navy take full advantage of the tremendous technology available today in the United States to truly revolutionize its thinking and operations?

- Although the U.S. military possesses great technological advantage over potential adversaries, military innovation is not limited to the introduction of new technologies and equipment. New concepts, ideas, and strategies must also be added for major--even revolutionary--innovations. The U.S. Navy today is publicly committed to two of the innovations specified in the first page of this thesis--a new doctrine, and a new strategy. The question is, will they succeed?

- The Navy's new strategy, *Forward . . .From the Sea,* places the focus away from the Navy's traditional blue-water emphasis toward the littoral, and support of operations ashore. The likely success of the new strategy hinges on transforming Cold War thinking and hardware designed for open-ocean warfare with the Soviets to new missions. The new strategy must be followed-up with concrete innovations in doctrine, tactics, techniques and procedures for the shift to be fully effective. Innovations undertaken, or not undertaken, and the success of such innovations during this period of relative peace will affect the Navy's role in future conflicts, and may shape future conflicts themselves. Does it appear that the Navy is taking the necessary steps to ensure that the new strategy will succeed, or is the Navy merely providing a new strategy to satisfy Congress and other outsiders who seek more joint oriented services?

This thesis will attempt to address some of these questions by examining the actions taking place in the Navy today and applying the lessons of successful innovation described by Rosen and others.

II. MODELS OF MILITARY INNOVATION

The central concern of this thesis is how to make the availability of new technologies combine with innovative thinking and actions to bring about a genuine revolution in military affairs (RMA) for the U.S. Navy. Using past studies of innovation in the U.S. Navy, what generalizations about successful innovation can be derived and applied today to ensure that the Navy maximizes benefits from the RMA?

Research for this project has been guided by the works of several authors. In particular, the writings of Vincent Davis, Ronald Kurth, Stephen Rosen, Barry Posen, Philip Signor and the team at the Naval War College who produced the report The Politics of Naval Innovation, have influenced this work.[1] This chapter summarizes key conclusions from three major studies of naval innovation.

Vincent Davis' work will be presented first. His The Politics of Innovation: Patterns in Navy Cases is the first study of contemporary naval innovation. Ronald Kurth focused specifically on internal and external politics with respect to technological naval innovation. His work is presented second. Stephen Rosen's Winning the Next War: Innovation and the Modern Military is the most exhaustive study of U.S. military innovations to date. He developed

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[1]The theory of military innovation put forth by Barry Rosen in The Sources of Military Doctrine: France, Britian, and Germany Between the World Wars is not proposed as a model for current naval innovation. Posen's theory essentially argues that military innovation comes from outside the military through civilian intervention. No major innovations in the U.S. Navy have supported Posen's thesis, and it is unlikely that new naval innovations will occur primarily as the result of civilian intervention either.

Philip Signor wrote an excellent history of the cruise missile in the U.S. Navy. His paper includes many lessons concerning naval innovation. Several of Signors's insights are included in the analysis section of this paper.

The Politics of Naval Innovation contains case histories of the introduction of cruise missiles into the Navy and the development of Aegis technology. Both cases were compared against models presented by Davis, Posen, and Rosen. Conclusions from the study are included in the analysis section of this paper.

separate models for a variety of conditions. His work is presented at the end of this chapter.

A. DAVIS' MODEL OF MILITARY INNOVATION

Vincent Davis' studies of the Navy's efforts to develop the capability to deliver nuclear weapons by carrier aircraft, the development of nuclear propulsion plants, the development of fleet ballistic missiles and several pre-World War II improvements led him to conclude that innovation generally requires an innovation advocate, most often found in the middle ranks--Lieutenant Commander, Commander, or Captain.[2] This advocate is seldom the inventor of the innovation that he promotes, but he usually possesses "a uniquely advanced technological knowledge pertinent to the innovation that is not generally shared within the Navy."[3] Davis observed that the innovation advocate is a passionate zealot--a man who "tolerates least well inefficiencies of any kind . . . If there is a better way to do it, he is determined to see it done the better way."[4]

There are drawbacks to becoming the passionate zealot that Davis describes, although the advocate himself often does not seem to care. According to Davis, "the innovation advocate seldom pays any attention whatever to the ways in which his crusading efforts may influence his personal career in the Navy or elsewhere."[5] Davis observed that success or failure in implementing the innovation does not

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[2]Davis, Politics of Innovation, 33.

[3]Ibid., 34.

[4]Ibid.

[5]Ibid., 35.

equate to career success or failure. Some are eventual winners, but many are losers.

Although Davis identified specific advocates for the innovations he studied, they did not bring about innovations unassisted. "The advocate's first step is usually to try to enlist supporters from among friends and colleagues at his own rank level."[6] The advocate's next step, whatever the success of the first, is to recruit supporters in key positions of authority and power at higher levels. Davis found that this vertical alliance is essential to the success of the effort.

In the cases Davis examined, he found that the advocate seldom sought allies or support from outside the Navy, preferring to settle disputes "in house." He concluded that the "pro-innovation coalition seldom seeks to sell its idea in terms of new conceptions . . . On the contrary, the usual gambit is to try to sell and justify the proposed innovation as a *better way to perform some well-established Navy task or mission.*"[7]

Davis hypothesized that while an innovation may have extensive consequences, advocates are either untrained "in the kind of intellectual operations required for political or strategic analyses,"[8] or the "advocates may have been instinctively aware that an innovation tends to result in changes within an organization, but that it would be easier to sell the innovation to the organization if the scope and magnitude of those changes were minimized during the selling period."[9]

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[6] Ibid., 36.

[7] Ibid., 37.

[8] Ibid., 38.

[9] Ibid.

Davis also observed that most innovations had opponents, and reported on the techniques of the innovation opponents as well. Unlike the innovation advocate, the "counter-alliance" usually emerges first at the senior rank levels and builds strength by finding members at gradually lower rank levels.[10] The most commonly used weapon that the counter-alliance uses against the pro-innovation coalition is that "it will cost too much." The counter-alliance does not want to be perceived as anti-progress, hence the "costs too much" argument. Decades ago, the "costs too much" argument was employed against adopting a particular innovation. More recently, the "costs too much" argument has been used against the costs of even exploring the new initiative.[11] Reagan's Strategic Defense Initiative (SDI), although not specifically a Navy project, was attacked in this manner.

Perhaps the most interesting of Davis' observations is that neither the pro-innovation, nor the counter-alliance group, makes its case on the long-range implications and consequences for international politics and competitive military strategies. Arguments were not framed in terms of enemy capabilities, unless the innovation was proposed specifically to cope with a specific threat.[12]

Davis identified inter-service rivalries as another key source of innovation. In the afterthoughts section of his monograph, Davis stated the hypothesis that he argued in The Admirals Lobby;[13] the emergence of the U.S. Air Force as a separate military service drove the other services,

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[10]Ibid.

[11]Ibid., 38-39.

[12]Ibid., 39.

[13]Vincent Davis, The Admirals Lobby (Chapel Hill: The University of North Carolina Press, 1967), 213-47.

especially the Navy, to compete with it. He argued that both the Air Force and the Navy believed that the other used World War II to put the other out of existence. He concluded that naval officers perceived the Air Force as a direct threat to the continued existence of the Navy, and therefore felt compelled to produce rival innovations to compete with the Air Force in order to survive as a prominent part of the U.S. armed forces.[14]

Although a civilian political scientist with no active duty experience,[15] Davis observed some key traditions within the Navy representing a culture favoring innovation. Specifically, he noted a naval tradition emphasizing "improvised expeditious solutions rather than prescribed procedures when confronted with a task."[16] In contrast, an Army man might take a more procedural approach and ask himself: "what do the rules and regulations say about dealing with this sort of matter?"[17] Depending on the answer to this question, the situation would be very carefully defined and specified then assigned to some staff group for discussion and recommendations.

Davis found, "in the Navy, on the other hand, tasks are viewed as things to be done in the quickest and most efficient manner rather than formal problems to be staffed."[18] Naval officers are inculcated from their earliest days of naval service to take action to get the job done, to be creative, persistent and imaginative--in short,

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[14]Davis, Politics of Innovation, 39.

[15]Davis spent nearly a decade from the late 1950s through the mid-1960s studying the U.S. Navy. He had frequent and regular access to active duty naval officers of various ranks who spoke with him both on and off the record.

[16]Davis, Politics of Innovation, 42.

[17]Ibid.

[18]Ibid.

to think. Most naval officers can recall being taught the story of "A Message to Garcia,"[19] a story in which a Marine Officer during the Spanish-American war is instructed to deliver a message to Garcia. The officer must overcome a series of obstacles to deliver the message, the first of which is finding out who Garcia is and where he is likely to be found.

Davis quoted a senior naval officer who, after reading an early version of his monograph, remarked

> "When an officer or an enlisted man in the Navy is assigned a task, he seldom thinks about consulting 'the book' but rather goes into immediate action to get the job done. Indeed, he seems especially pleased if he can think of shortcuts that ignore the 'book' solution."[20]

Davis concluded that the Navy's approach to tasks favoring improvised and expeditious solutions over elaborately considered solutions based on prescribed procedures is pragmatic, and has likely served as a catalyst for innovation in the Navy.

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[19]The essay, "A Message to Garcia," was originally published in 1899. The author of the essay was Elbert Hubbard. A recent article regarding the story can be found in "Ah, Sir, About That Message to Garcia . . . ," by Jack Herlocker, (LT), U.S. Navy, U.S. Naval Institute Proceedings, 113 (July 1987), 98-99.

[20]Davis, Politics of Innovation, 42.

B. KURTH'S MODEL OF MILITARY INNOVATION

As a junior officer, Rear Admiral Ronald Kurth wrote his doctoral thesis[21] about the politics of innovating within the U.S. Navy. In the introduction to his thesis, he described what he perceived as significant technological innovation taking place outside the military while, at the same time, the Navy was failing to meet its needs for technological innovation. He saw naval innovation as haphazard, and perceived a need for more information concerning the process of technological innovation. He wrote, "the certainty that the Navy must achieve more responsive technological innovation provides the motivation to continue the search for a better understanding of the innovative process."[22] Although nearly twenty-five years have passed since Rear Admiral Kurth wrote his doctoral thesis, scholars and America's armed forces still seek a better understanding of the process of innovation in the military.

Kurth surveyed historical naval innovation, and then researched two innovations in great detail--the genesis of nuclear power for submarines, and the development of the POLARIS fleet ballistic missile system. Besides chronicling the two cases, Kurth made important contributions to the literature on military innovation by explaining political elements in the process of innovation. Kurth, like many naval officers of that era, was clearly influenced by the writings of Vincent Davis whose books Postwar Defense Policy and the U.S. Navy, 1943-1946, and The Admirals Lobby, and monograph, The Politics of Innovation: Patterns in Navy

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[21]Rear Admiral Kurth received his Doctor of Philosophy in Political Science from the Government School at Harvard University in 1970. His doctoral thesis is entitled, "The Politics of Technological Innovation in the United States Navy."

[22]Kurth, 1.

Cases, were published in 1966 and 1967. Whereas Davis described the process by which innovation advocates or zealots advanced their cases by arguing a better way of doing essentially the same task or mission, Kurth wanted to look at what he called "innovative departures."[23] He described an innovative departure as a "radical departure from the technology supporting existing weapons systems."[24]

Incremental innovations, on the other hand, are the small things that the services do "which adds a new dimension of usefulness to an existing weapons system."[25] They help to steady and focus the organization by improving it and making it more efficient. Proponents of incremental innovations are often seen as "rocking the boat," but their innovations do not threaten to sink the boat. On the other hand, advocates of an innovative departure are nearly always viewed as trying to sink the boat. The distinction is perhaps more readily apparent to a military officer because, in Kurth's words, "the authors of incremental innovations are much appreciated and well rewarded by the Navy."[26]

Kurth observed that innovative departures are difficult to implement because they destabilize the organization "by endangering the usefulness of a weapon system around which a military life style is built."[27] He cites the nuclear submarine as an example for two reasons: first, because the new technology condemned the conventional submarine force to obsolescence; and second, because Admiral Rickover generally

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[23]Ibid., 2.

[24]Ibid.

[25]In his thesis, "Politics of Technological Innovation" (2), Kurth provided examples including "the change from hydraulic to the steam catapult, from the landing signal officer to the mirror landing system, and from the axial carrier deck to the angled deck."

[26]Kurth, 3.

[27]Ibid.

denied transition to the nuclear program to those in the conventional submarine hierarchy.[28]

Both Kurth and Davis observed that the politics of incremental innovation are comparatively free of conflict. Yet Kurth concluded the politics of innovative departure are likely to be complex.[29] Advocates of innovative departures are rarely rewarded and are frequently discredited or ostracized by their own service.

> Political resolution of conflict generated by the destabilizing effect of a successful innovative departure is usually necessary. The Congress can be expected to play an influential role in the innovative process and contribute to the resolution of conflict within the Navy or among the services.[30]

In each innovation that he studied,[31] Kurth identified an innovation advocate who became what he termed a zealot.[32] Politics sometimes meant that the zealot would receive sufficient "encouragement to sustain motivation but not enough support to gain action."[33]

In contrast to Davis, Kurth found an institutional resistance to change in the Navy due to the way it is organized. He concluded that the Navy is optimized to administer and perform routine tasks; as such, it has

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[28] Ibid.

[29] In his thesis, "Politics of Technological Innovation" (3), Kurth uses the term politics to describe "all of the means by which advocates of innovation attempt to influence policy in order to obtain a commitment in support of the innovation."

[30] Ibid., 3-4.

[31] In addition to the introduction of nuclear power propulsion, and the Polaris System into the U.S. Navy, Kurth covered (in far less detail) W.S. Sims' gunnery improvements, Reginald Henderson's (Royal Navy) convoying, and Billy Mitchell's quest for air power.

[32] Davis also called innovation advocates zealots although Davis did not differentiate between incremental innovation and innovative departures.

[33] Kurth, 11.

difficulty adapting to change. Kurth observed that military bureaucracies emphasize tradition, stability, "loyalty, trained habit and confident attachment to existing instruments of warfare."[34] Perhaps the difference between Kurth's and Davis' view on this matter can be partially attributed to Davis' lack of active duty experience in contrast to Kurth's. As an active duty naval officer, one can clearly see, and observe firsthand, the rigid bureaucratic aspects of the Navy, and at the same time not realize how less rigid and bureaucratic the Navy is compared with other services.

Kurth observed that the different methods the Navy used in applying technological innovation were not reflected in the literature. "Frequently, an oversimplification is made which lumps together all aspects of innovation in one conceptual basket, when in fact there are large differences among attempts at technological innovation."[35] He observed that the Navy's record for incremental innovation goes unnoticed "because attention is focused on innovative departures which occur only by persevering against great difficulty."[36] Great human efforts and triumphs make more interesting reading, and when authors document these struggles the Navy's rich history of successful technological innovation appears distorted. Kurth concluded that the literature on military innovation describes interesting innovative departures to illustrate the difficulty of innovating in service bureaucracies, while in

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[34]Ibid.

[35]Ibid., 44.

[36]Ibid, 44-45.

reality, incremental innovation occurs at a high rate, and innovative departure is slow, difficult, and less common.[37]

Kurth postulated that since incremental innovation is so much easier to achieve, naval innovators often try to adapt a radical innovation by an incremental process in which the introduction of the new innovative departure is stretched out over many years. Here Kurth's findings are consistent with Davis' observations about the method in which advocates seek support for their projects.

Kurth's study of the U.S. Navy from the turn of the century until the late 1960s revealed that "this process [of attempting innovative departures incrementally] has become less possible after the mid-century point."[38] Kurth does not elaborate on this point; however, he may have drawn that conclusion because at that time the rapid pace of technological progress was driving more rapid military innovation.[39]

1. Challenges to True Innovative Departures

Although there are many challenges that the innovative zealot faces, Kurth identified key factors that he found were central and common to the difficulties of innovative technological departures in the Navy. Two factors will be

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[37]Ibid., 45.

[38]Ibid.

[39]Many authors have addressed the subject of the increasing pace of technological progress and its impact on militaries. In general, they conclude that technology is changing so rapidly that militaries are necessarily driven to incorporate new technology more quickly. See Alvin and Heidi Toffler, War and Anti-War: Survival at the Dawn of the 21st Century (New York: Little, Brown and Company, 1993), Martin van Creveld, Technology and War From 2000 B.C. to the Present (London: Brassey's (UK), 1991), also van Creveld's The Transformation of War (New York: The Free Press, 1991), Matthew Evangilista, Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies (Ithaca: Cornell University Press, 1988), and John Keegan, A History of Warfare (New York: Alfred A. Knopf, 1993).

examined here. The first is loyalty, the principal and governing value in the navy style of life. The second is the Navy belief that the military ethic must remain apolitical.[40]

Kurth reported, naval officers are loyal not only to service, but also to their subunit and/or community. The "problem" of loyalty in innovation is illustrated in the following excerpt from a letter to the U.S. Naval Institute Proceedings in 1965 by a recently retired Navy Captain:

> Each service has its own honorable traditions: its esprit de corps. These attract promising young men to dedicate their lives to a career of service which they consider worthy of respect, and perhaps leading to glory. The service is the avenue to promotion and recognition. If a change in world politics, technology, tactics or strategy (and changes come rapidly these days) threatens the relative standing of one of the services, what happens? The service cannot attract good young men, the prospect of recognition dissipates, and the service maintains itself with difficulty. No senior officer who has dedicated his life to the country through his branch of the service is going to accept the threat lightly. In addition to his own aspirations, the officer carries on his shoulders the weight of those who have preceded him in honorable service, as well as the future of all the young careerists he has inspired to look toward the future in that service.
>
> Although it may be unconscious, a consequence of the service system is a tendency to oppose blindly and utterly any tactical or strategic development which might be foreseen, even dimly, as a threat to one's own service. Accepting the diminution of one's own service role may be military professionalism on a high level, but it may also betray a lack of appreciation for the system which provides the next generation of leaders.[41]

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[40] Ibid., 48-51.

[41] Lincoln A. Baird, CAPT, USN (Ret.), U.S. Naval Institute Proceedings, 91 (July 1965), 106-07, quoted in Kurth, 54.

Kurth expanded Captain Baird's view of service loyalty to include community loyalty. He observed that, in the navy, community loyalty dominates service loyalty. Thus, a fighter pilot may view himself as part of the Navy's "tacair" (tactical aviation) community first, and a part of the carrier Navy second, and as a Navy man third. This loyalty to subunit is effective in motivating service members to pursue higher subunit performance and may "precipitate even stronger locally-oriented professionalism."[42] Kurth concluded, "subunit identification may become a more dominant force than any other."[43] As a result, Navy-wide organizational goals such as "keeping the peace" may translate (at the subunit level) into "keeping the carriers." Thus Kurth concludes, "the decentralization of primary loyalty among subunits may produce a hostile response to internal attempts at change."[44] Kurth postulated that even the Chief of Naval Operations (CNO) is not immune to challenges should he threaten or challenge subunit loyalties.[45]

Despite the strong subunit identification that Kurth observed, Navy loyalty overrides subunit loyalty in the face of challenges from outside the Navy such as, perceived challenges from the Air Force for missions being performed by the Navy. Strong subunit loyalty helps perpetuate a system where innovative departures considered within the larger organization will be vigorously opposed by the members of the subunit whose existence is being threatened.

In Samuel Huntington's classic The Soldier and the State, Huntington describes the apolitical military ethic

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[42]Ibid., 46.

[43]Ibid.

[44]Ibid., 47.

[45]Ibid., 63.

that must be "non-dated and non-localized . . . a constant standard to judge the professionalism of any officer corps anytime anywhere."[46] Kurth identified a relationship between the apolitical military ethic and loyalty.

> Such an ethic is held to be free and uncorrupted by the transient nature of the instant's politics. Since loyalty is the heart of the military ethic, loyalty must be free of a transient, politically based definition, or risk the destruction of the military ethic.[47]

Herein resides a fundamental conflict according to Kurth. He pointed out that the military ethic is, to a certain degree, guarded by mechanisms to keep it free of politics, and yet through his case studies he concluded, "without politics an innovative departure is unlikely. Hence a desire to preserve the 'purity' of the military ethic serves to restrict the realization of an innovative departure."[48]

2. Characteristics of the Innovation Zealot

Given the adversity that innovative zealots face, where do the services find innovation zealots? Kurth examined the careers of particular innovation zealots, and identified some telling characteristics.

One type of zealot, typified by W. S. Sims, was languishing at junior rank, and saw innovation as a form of escape and adventure.[49] In Sims' case, improvement in gunfire was only the first of the many innovations he

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[46]Samuel P. Huntington, The Soldier and the State (Cambridge: Harvard University Press, 1959), 62, quoted in Kurth, 49.

[47]Kurth, 49.

[48]Ibid.

[49]In 1901, when he began to press for improvements in naval gunfire systems, Sims was a forty-three year old Lieutenant.

championed. He developed a dedicated passion for innovation. Sims could not adjust to complacency or mediocrity, and he never did.[50]

Another type of zealot may restrain himself, and go on quietly in his career, appearing to support the status quo until he acquires experience, and accumulates enough rank and power to express his plan for change.[51] Kurth did not elaborate on the purpose or methods of this zealot. He did however, point out that high rank alone does not guarantee success of a given innovation. In fact, he concluded "it is unlikely that [even] the Chief of Naval Operations could perform, only by virtue of his own will, an innovative departure."[52]

A third type of innovative zealot "is developed from the officer who perceives conflict between the needs of his country and the norms of his service."[53] This type of zealot often has normal "service-based" loyalties that become overtaken by the pursuit of a higher cause. Kurth names both General Mitchell (USAF) and Commander Henderson (RN) as probable zealots of this type. He wrote,

> each had a conventional dedication to their service until such time as a greater loyalty seemed called upon. Indeed, each might have claimed that his actions were based on a clearer perception of service loyalty.[54]

The last type of zealot that Kurth identified is modeled on the examples of Admirals Rickover and Raborn. Kurth devoted a large section of his thesis to their careers

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[50]Kurth, 64.

[51]Ibid.

[52]Ibid., 63.

[53]Ibid., 64.

[54]Ibid.

and their innovative departures. Both Admiral Rickover and Admiral Raborn were initially unenthused with the idea of becoming a zealot, however they eventually became passionate in pursuit of their programs--nuclear propulsion for Admiral Rickover and fleet ballistic missiles for Admiral Raborn. Rickover and Raborn became what would later be called program managers.

Kurth believed zealots were mavericks. His description of Admiral Rickover caused this reader to conclude that Rickover was a maverick.

> Admiral Rickover, at different times, found himself in conflict with the Submarine Force, the Navy and the Defense Department. Furthermore, Admiral Rickover's formal and informal channels to Congress are well defined in the public record of Congressional committees.[55]

Raborn and Rickover were exceptional men. Kurth observed the combination of creative or innovative talent and tact are rarely coincident in the same individual. "If an individual is an independent thinker, a source of new and different ideas, he is likely to be rather independent in his dealings with other people. He is not likely to be orthodox in conduct and to conform graciously."[56] Kurth reported that "some innovators, if judged by their actions, seemed convinced that tact is deleterious to the awakening effect desired in the conflict surrounding innovation."[57] Today, we might describe this talent as "media savvy." Admiral Rickover was judged capable of being sensational in his public statements to rouse the public to exert pressure

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[55]Ibid., 83.

[56]Lewis A. Dexter, "Some Strategic Considerations in Innovating Leadership," in Alvin W. Gouldner, ed., Studies in Leadership (New York: Russell & Russell, 1965), 592, 598, cited in Kurth, 383.

[57]Kurth, 383.

on senior naval officials to recognize the need for his innovation.[58]

While proponents of incremental innovation are rewarded handsomely for "extending weapons system usefulness and conserving funds,"[59] Kurth observed that zealots' careers suffer because the effort required to cause an innovative departure takes the zealot "out of the mainstream of organizational life by the demands of an innovative project whose complexity requires years of attention."[60] Naval officers cannot generally afford years selling an innovation at the expense of rounding out one's career. The officer who remains loyal to an innovative departure is likely to "pay the price to his promotion selection board." Therefore, the system exerts conservative control over innovation.

It is a rare individual who will persevere in the face of great challenge, knowing that his actions will probably hurt his career prospects and opportunities. Admirals Rickover and Raborn both achieved flag rank, but the costs were enormous. For every Rickover or Raborn there are dozens of men whose careers have been damaged, and they, along with their idea, fade away.

Kurth acknowledged that there are probably other types of innovators in the military but he leaves it to others to discover and chronicle their experiences.

3. How do True Innovative Departures Succeed?

A key to the success of an innovative departure is strong leadership, usually exercised by one man who may be called the innovative zealot. To

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[58]Ibid., 383-84.

[59]Ibid., 84.

[60]Ibid.

> innovate successfully, the zealot must have resilience and inner strength to accept for himself an environment of pressure and conflict.[61]

In addition to the zealot's inner drive, he must develop political allies to protect himself and his program. Kurth concluded that "the navy accomplishes innovative departure only with outside political assistance."[62] because the Navy lacks the internal means to resolve the conflict generated by the pursuit of innovative departure.[63]

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[61]Ibid., 48.

[62]Ibid., 65.

[63]Ibid., 66.

C. ROSEN'S MODELS OF MILITARY INNOVATION

Steven Peter Rosen has written extensively about innovation in the modern military.[64] His 1991 book Winning the Next War: Innovation and the Modern Military described two types of military innovations: behavioral (or social) and technological. Behavioral innovations are those hastened by operational behavioral changes. Changes due to the creation of new military technologies, e.g., guided missiles, radar, electronic warfare, and so on Rosen labeled technological innovations. He further differentiated between two classes of operational behavioral innovations, those that occurred in peacetime and those that occurred in war. To address these differences Rosen developed separate models for innovation during peacetime and wartime, and those that resulted from new technologies.[65]

During his research Rosen encountered numerous cases of failure to innovate, but decided to direct his energies toward understanding successful innovation since he found there was already a vast literature on bureaucratic inertia in the military. He understood the need to study and explain successful military innovation.[66]

In Rosen's examination of the American armed forces he found far more cases of successful innovation than failures. Where failures were found in U.S. cases, the failures typically resulted from a failure to innovate rather than a failure of the intended innovation. For that reason, he

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[64]Unlike other authors who studied one or two, or at most, five cases of innovation, Rosen's book Winning the Next War: Innovation and the Modern Military (Ithaca, NY: Cornell University Press, 1991), contains the results of his research into twenty-one innovations, including both successes and failures.

[65]Rosen, Winning, 5.

[66]Ibid.

examined cases of failed innovations drawn primarily from the British military.

The cases Rosen used to illustrate his models of innovation were both revolutionary and highly successful. They were very important to their respective services. In fact, Rosen first chose the innovation he believed represented the most important decision undertaken to that point in a particular service's history.[67] For example, Rosen examines the U.S. Navy's decision to integrate carrier aviation into a battleship navy, the U.S. Army's adoption of helicopter airmobility, and the U.S. military's adoption and integration of technological advances such as guided missiles, proximity fuses, and radar. Where he chose other less important innovations, it was to test other theories of innovation.[68] He chose to exclude innovations aimed at increasing efficiency.[69]

Like Kurth, Rosen was interested in *major* innovations, ". . . a change in one of the primary combat arms of a service in the way it fights or alternatively, the creation of a new combat arm."[70] Rosen also drew the distinction between tactical innovations and major innovations. Tactical innovations involve the change in application of an individual weapon to a target and environment in battle.

Major innovations, the focus of Rosen's studies, involve changes in the *concept of operation* of a combat arm, that is, it forces one of the primary combat arms of a service to change its concepts of operation and its relation

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[67]Ibid., 7.

[68]Ibid.

[69]Rosen's use of the term "major innovation" differs from Davis' study explained above. Whereas Davis examined new technologies that were used to perform existing missions better, and not to change them radically, Rosen deliberately sought what he considers a major innovation, something that did alter the combat arm of a service radically.

[70]Rosen, Winning, 7.

to other combat arms, and to abandon or downgrade traditional missions."[71] A major innovation forces an armed service to change "the ideas governing the way it uses its forces to win a campaign."[72] A major innovation, by Rosen's definition often involves the downgrading or abandoning of older concepts of operation and possibly a formerly dominant weapon.

Rosen concluded that changes in doctrine can, but may not necessarily, represent a major innovation. His litmus test for innovative doctrine is whether it leaves the essential workings of an organization unaltered. If so, it does not satisfy his definition of a major innovation. For doctrine to be considered innovative, it must contain revolutionary, not just evolutionary, concepts.[73]

1. Model for Successful Peacetime Military Innovation

Inter- or postwar periods historically have been periods that have had tremendous impact on the military.[74] Usually the impact has been perceived as detrimental to the military as a whole, and the Navy in particular. But that is not always the case. Changes do indeed occur, both the result evolution and innovation. This study, in seeking to draw conclusions about current innovations, will present two of the three innovation types found in Rosen's Winning the Next War--peacetime behavioral and technological innovations.

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[71]Rosen, "New Ways of War," 134.

[72]Ibid.

[73]Ibid., 8.

[74]The description of recent periods of peace as "inter- or postwar" can be found in James L. George, The U.S. Navy in the 1990s: Alternatives for Action (Annapolis: Naval Institute Press, 1992), 1.

Although change is driven by both evolutionary and innovative processes, Rosen found that peacetime innovations played a significant role in shaping today's U.S. Navy and Marine Corps. Success in peacetime innovations is not the unique province of the Navy and Marine Corps; he observed that successful peacetime innovations occurred with remarkable similarity irrespective of service. Rather than being imposed from civilians outside the military as argued by Posen,[75] Rosen observed that the key to successful peacetime innovation was "new ideas [developed by officers within the military] about the ways wars would be fought in the future and how they might be won."[76]

In laying out his peacetime model, Rosen begins by myth-bashing. For example, conventional wisdom might lead one to believe that failure or defeat in wartime is necessary for peacetime innovation.[77] One might think that this would be especially true during periods immediately following wars. Defeat in wartime can certainly be a motivator in causing change, but defeat "does not tell an organization what future wars will look like, only that its preparations for the war just ended were inadequate."[78] History is replete with examples of defeated armies and navies who went on being defeated because they failed to

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[75]In the conclusion to his book, The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars (Ithaca, NY: Cornell University Press, 1984), (224), Barry Posen writes, "innovation should occur mainly . . . when civilians with legitimate authority intervene to promote innovation."

[76]Rosen, Winning, 57.

[77]This is a conclusion made by Posen in Sources of Military Doctrine (224).

[78]Rosen, Winning, 9-10.

innovate.[79] Rosen concluded that failure in wartime is not a requisite for peacetime innovation.

Posen,[80] Kurt Lang[81] and others have argued that because of their peculiar organization and culture, militaries are "unlikely to innovate at all if left to themselves: military innovation must be the result of civilian intervention." Rosen concluded that civilian intervention may be a factor in successful innovation, but it does not explain all innovation. For example, Rosen reported that by 1967 President Johnson knew that he was not content with the way the military was fighting in Vietnam, but he could not give unambiguous orders to the military because he did not know exactly what he wanted. Johnson did not want the military to suggest using the atom bomb, or to send more men because he could think of those solutions on his own. He wanted the Joint Chiefs to "'search for imaginative ideas to bring this [Vietnam] war to a conclusion.'"[82]

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[79]Two examples cited by Rosen in Winning (9), include the czarist army after the Russo-Japanese War and the U.S. Army's failure to "rush to develop innovative capabilities for counterinsurgency after the Vietnam War." See also, John Bushnell, "The Tsarist Army after the Russo-Japanese War: The View from the Field," in Charles R. Shrader, ed., Proceedings of the 1982 International Military History Symposium: The Impact of Unsuccessful Military Campaigns on Military Institutions 1860-1980 (Carlisle Barracks, PA: U.S. Army War College, 1982), 77-99, and John P. Lovell, "Vietnam and the U.S. Army: Learning to Cope with Failure," in George Osborn, ed., Democracy, Strategy, and Vietnam (Lexington, MA: Lexington Books, 1987), 121-54.

[80]Barry Posen studied the British Royal Air Force, the French army, and the German army during the period between the two World Wars. He concluded that "we see little internally generated innovation in the three cases." Specifically, Posen argues, the French Army failed to innovate; the German army's changes did not represent true innovation; and the Royal Air Force innovated only after civilian leaders administered an external shock. [Posen, pp 224, 226 cited in Rosen, Winning, pp 9-10]

[81]Kurt Lang, "Military Organizations," in James G. March, ed., Handbook of Organizations (Chicago: Rand McNally, 1965)

[82]Minutes of 12 September 1967 weekly luncheon with Secretaries Dean Rusk and Robert McNamera, Walter Rostow, George Christian, Harold Johnson, Jim Jones, notetaker, Declassified Documents Registry Service, 1987, #1798, quoted in Rosen, Winning, 10.

Rosen cited Richard Neustadt's

> five conditions that must prevail if a president's order is to be readily obeyed by his bureaucratic subordinates. The president himself must be clearly involved in the decision, and his order must be unambiguous. His order must be widely publicized, and 'the men who receive it [must have] control over everything needed to carry it out,' and they must have no doubt of his 'authority to issue' the order.[83]

The difficulty civilians encounter in getting the military to innovate is compounded by the ambiguity of such an order. Military men are accustomed to well-defined tasks, and may lack the "unconventional creativity" to carry out such an order. Also, some in the professional military may believe that ordering the military *how to fight* may be outside the bounds of the legitimate authority of the civilian leadership.[84]

Next, Rosen tackled the myth of "military mavericks" changing their services. Rosen seems to sidestep the issue by careful selection of criteria for mavericks. He uses the term in its dictionary sense[85] to exclude the individuals most often cited by others as mavericks, for example, Billy Mitchell, B. H. Liddell Hart, Charles de Gaulle, and Hyman Rickover.

Rosen concedes that Billy Mitchell was a maverick, but denigrates his impact on air development. He cites Henry "Hap" Arnold's claim that Mitchell created resistance within the War Department, and caused others to take a more narrow view of aviation as an offensive power in warfare.[86]

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[83]Richard Neustadt, Presidential Power (New York: John Wiley, 1980), 16, quoted in Rosen, Winning, 11.

[84]Rosen, Winning, pp 10-11.

[85]Webster's defines a maverick as "an independently minded person who refuses to abide by the dictates of or resists adherence to a particular group." [Webster's, 704.]

Similarly, he acknowledges that both Liddell Hart and de Gaulle were advocates of innovation in ground warfare. By taking their cases outside military channels to the civilian chiefs of their war departments, Rosen concludes, "as with Mitchell, the judgment of history is that by doing so they probably reduced the willingness of the professional military to consider innovation."[87]

In the case of Hyman Rickover and the nuclear navy, Rosen concludes that the image of "'Rickover against the navy'. . . . was a myth deliberately created by Rickover."[88] While it may have been advantageous for Rickover's program to have the level of Congressional support that it received, Rosen concludes

> nuclear propulsion was obviously in the interest of the Navy, particularly the submarine force, and senior navy officers supported it before Rickover emerged as its most visable advocate, and they supported Rickover despite, and not because of, his aggressive self-promotion and cultivation of an independent role.[89]

a. Sources of Peacetime Military Innovation

In his quest for explanations of military innovation during peacetime, Rosen found that innovation is often rooted in the services themselves. The military services are not monolithic structures, nor are they

> composed of subunits simply pursuing their own organizational self-interests. U.S. Army officers

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[86]Henry Arnold, Global Mission (New York: Hutchison, 1951), 97, cited in Rosen, Winning, 12.

[87]Rosen, Winning, 13.

[88]Ibid., 12.

[89]Rosen cites several sources for Rickover material. The myth in action is best described in the statements of Senator Henry Jackson cited in Michael Armacost, The Politics of Weapons Innovation: The Thor-Jupiter Controversy (New York: Columbia University Press, 1969), 65-66, cited in Rosen, Winning, 12.

> may come from the infantry, artillery, armor, aviation, airborne, or special forces. Navy officers may be carrier pilots from the fighter or attack communities, antisubmarine warfare pilots, submariners, surface ship commanders, or from an amphibious force. Each branch has its own culture and distinct way of thinking about the way war should be conducted, not only by its own branch, but by other branches and services with which it would have to interact in combat.[90]

Despite these divisions or professional factions, there is nevertheless general agreement among the various branches about how they should work together in wartime, and this is a sign of a healthy organization. Rosen also argues that the balance between the services is not static. Rather, he contends that there will be vigorous debate particularly over the relative priority of roles and missions, especially in times of constrained resources. Since victory in war ultimately legitimates military organizations, there will also be arguments over what the next war will or should look like. It is here that Rosen says the seeds of innovation are sown: in the ideological struggle around a new theory of victory. The new theory of victory must contain an explanation of what the next war will look like and how officers must fight if it is to be won.[91]

Rosen's studies of successful and failed innovations led him to conclude that shifts in ideology or strategy by themselves are insufficient for the innovation to succeed.

> The new theory must be translated into concrete, new tasks that are performed every day, in peace and in war, . . . without the development of new critical tasks, 'ideological' innovations remain

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[90]Ibid., 19.

[91]Ibid., 19-20.

> abstract and may not affect the way the organization actually behaves.[92]

What is more important, Rosen concluded that officers who are successful at performing tasks related to the new theory of victory must be given opportunities to compete in a career path that provides them a reasonable chance for success.

One important source of power in the military is control over the promotion of officers. The intellectual struggle over theories of victory is not immune from such power considerations. In fact, supporters of the new theory must wage a "hard-headed, concerted effort to gain control over whatever mechanisms determine who becomes an admiral or general."[93] There are several reasons for this. First, if a career in the new field leads to a dead end, only the slow and the uninformed will fill the ranks. Second,

> the creation of a new promotion pathway to the senior ranks, [is necessary] so that young officers learning and practicing the new way of war can rise to the top, as part of a generational change.[94]

The new pathway ensures that the new skills are not relegated to professional oblivion. For example, if the new skill is viewed merely as a technical specialty, then officers possessing that skill will not be seen as having the broad background that qualifies them for flag rank.

After discussing promotion pathways, Rosen returned the subject of mavericks. He argued that mavericks by definition lack the necessary political power within the service to create pathways for promotion or to protect

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[92]Ibid., 20.

[93]Ibid.

[94]Ibid.,20-21.

junior officers. Simply put, change must come about "through the actions of those who have power."[95]

Rosen concludes that civilians can play a role in the protection of junior officers and/or advocates, but that role is limited because civilians, acting alone, possess little "legitimate" political power in the promotion of officers. Civilians by themselves cannot legitimize their military proteges; they can help protect military innovators, but the innovators must establish legitimacy within the officer corps itself.

In short,

> Peacetime military innovation occurs when respected senior military officers formulate a strategy for innovation, which has both intellectual and organizational components. Civilian intervention is effective to the extent that it can support or protect these efforts.[96]

2. Model for Successful Technological Military Innovation

Rosen categorized both peacetime and wartime innovation as "social innovation," that is, concerned with changing the way men and women in organizations behave. Technological innovation is concerned with machinery--the hardware of war. The two types of innovation are integrated differently. Just as he bashed myths in laying out his peacetime model, Rosen raised and refuted rival hypotheses as he substantiated his model for technological innovation.

First he addresses the idea that intelligence about enemy capabilities drives technological innovation. He

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[95]Ibid., 21.

[96]Ibid., 21.

[97]Ibid., 40.

concludes, "the overall picture of American military research and development . . . is one of technological innovation largely unaffected by the activities of potential enemies, a rather self-contained process in which actions and actors within the military establishment were the main determinants of innovation."[98]

Although primarily concerned with machinery, technology interjects a new set of actors--scientists--into the environment in which military decisions are made.[99] Rosen and Davis both found that most of the Navy's greatest technological innovations were invented by civilian scientists outside the Navy. Whether it is because of potential large contracts, or another reason, civilian scientists and inventors frequently knock on the doors of the Navy. Despite the "push" from the scientific community, technological innovation also generally required the vision of active duty officers to express how the new technology could benefit the service and contribute to winning the next war.

Rosen found a vast literature concerning technological innovation in the business world, and much less that applied directly to the military. Studies of technological innovation in the military are divided into many areas. Some like Kurth, examined the bureaucratic politics of technological innovation. Others have tried to determine the appropriate rate of technological innovation. Some have attempted to determine whether demand (need) pulled innovation, or whether scientific progress created a technology push.[100] Rosen reported that the literature is inconclusive about the "demand pull" and the "technology

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[98]Ibid., 250.

[99]Ibid., 40.

[100]See Rosen, Winning, 39-53, for an array of sources.

push" positions since there is evidence supporting both hypotheses and they are not mutually exclusive, i.e., sometimes it may happen one way and sometimes the other.

Some writers have tried to examine whether intelligence about enemy capabilities played a role in technological innovation. Other analysts have tried to perform some cost-benefit analysis about technology. On the matter of enemy intelligence driving technological innovations, Rosen found no clear pattern.

> Technological innovation was not closely linked with either intelligence about the enemy, though such intelligence has been extremely useful when available, or with reliable projections of the cost and utility of alternative technologies. Rather, the problems of choosing new technologies seem to have been best handled when treated as a matter of managing uncertainty.[101]

[101]Ibid., 251.

III. THE MILITARY-TECHNICAL REVOLUTION[1] (MTR)

> Then in the short space of twenty years sails gave place to steam, wood to metal, oak to armor, and smooth bores to rifled cannon.
>
> S. S. Robison

> Military analysts believe there have been four military technical revolutions; development of the internal combustion engine; use of the blitzkrieg by the Nazis as an operational art; development of atomic weapons; and current generation military affairs. These are periods marked by such distinct technical advances and operational innovations that the very nature of warfare changed.[2]

The concept of a military-technological revolution may be relatively new, but as the previous paragraph indicates the present revolution is not the first. This chapter introduces the concept of today's Military-Technological Revolution (MTR) and briefly describes its introduction into U.S. thinking and debates. Additionally, this chapter addresses current trends in the MTR as they are relevant to the U.S. Navy.

A. HISTORY OF THE MILITARY-TECHNICAL REVOLUTION (MTR)

Andrew Krepinevich formerly of the Office of Secretary of Defense (Net Assessment) traces the idea of a "military-technical revolution" from Russian military writings of the 1980s."[3] Beginning in the early 1980s, top Soviet officers, including Marshal Nikoli Ogarkov, worried that a revolution

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[1]The literature contains references to both a Military-*Technical* Revolution and a Military-*Technological* Revolution. The author has found no distinction between the two. The terms appear to be used interchangeably.

[2]"U.S. Group to Assess Military 'Revolution,'" Jane's Defense Weekly, 16 April 1994, WESTLAW, 2674440.

[3]Andrew F. Krepinevich, Jr., The Military-Technical Revolution: A Preliminary Assessment (Washington, D.C.: Office of Secretary of Defense (Net Assessment), July 1992), p. 3, quoted in Hayes, et al., 1.

in the linking of technology and weapons would leave their country behind.[4]

Although the Russians may have been the first to recognize, and write about the current revolution, there are references to the "military-technical revolution," and "revolution in military affairs" in Soviet writings from the early 1960s as well.[5] In the introduction to Military-Technical Revolution John Erickson describes how "the substance of a once-familiar stability has been consumed with fiery abruptness by the onset and the cumulative technical triumphs of the 'military revolution' that centers around nuclear weaponry."[6] Essays in the book describe how weapons of mass destruction, intercontinental ballistic missiles, anti-ballistic missile defense systems, guided weapons and the concept of limited war constitute the revolution.

There is even an essay entitled, "The Future of Manned Aircraft," in which its author describes the conditions necessary to eliminate manned aircraft as effective weapon systems. The arguments raised are virtually the same arguments being raised today. Manned combat aircraft continued to play a huge role in the world's armed forces following the last MTR; the question is will they still play as large a role following the next MTR?

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[4]"War Convinced Soviets They Were Right About Battle Philosophy," Aerospace Daily, 16 October 1991, WESTLAW, 2539944.

[5]For example, the book entitled, The Military-Technical Revolution: Its Impact on Strategy and Foreign Policy, was published for the Institute for the Study of the USSR, in Munich, Germany in 1966. The book was the outcome of a symposium held at the institute in Munich in October 1964, a few days after the fall of Nikita Khrushchev and the explosion of an atomic device by the Chinese Peoples Republic.

[6]John Erickson, ed., The Military-Technical Revolution: Its Impact on Strategy and Foreign Policy (New York, Frederick A. Praeger, 1966), 1.

B. THE CURRENT MILITARY-TECHNICAL REVOLUTION

In the late 1980s, the term military-technological revolution (MTR) began to appear in in the open press. The MTR was describing the Soviets' perception that future wars would be radically different from those of the past. By February of 1990, the Pentagon's five-year defense planning guidance (DPG) "directed the services to conduct 'aggressive' research and development, including programs of 'limited production' and experimentation . . . in equipment and operational concepts.'"[7] The DPG's directions came at a time when it was assumed that the defense budget would be cut substantially, and yet the Pentagon's planning guidance called for R&D to be speeded up to exploit what the Soviets were calling the MTR. Many believed that the MTR meant "more bang for the Buck." As early as 1989, some liberals were citing the MTR as reason for halving the defense budget.[8]

Analysis of the 1991 Gulf War seemed to confirm what the Soviets were writing and saying--the military-technological revolution has begun.

> Frank Kendall, deputy director of tactical warfare programs in the Defense Research and Engineering office, said the Soviets "have taken the results of the [Persian Gulf] war and looked at them against their concept of the military-technological revolution and concluded that" there is a near match.[9]

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[7]"Five-Year Defense Guidance Assumes CFE, Calls for Aggressive R&D," Aerospace Daily, 8 Feb 1990, WESTLAW, 2210921.

[8]Former Pentagon advisor, William H. Kaufman, of Harvard University, proposed cutting the defense budget from $305 billion to $160 billion by 1999. See "Ex-Defense Advisor Calls for Budget 'Revolution,'" San Francisco Chronicle, 22 November 1989, WESTLAW.

[9]"War Convinced Soviets They Were Right About Battle Philosophy," Aerospace Daily, 16 October 1991, WESTLAW, 2539944.

In the Gulf War, there was far less reliance on direct fire then in the past. The U.S. was able to "see the battlefield in depth and breadth, quickly communicate target data, and strike with weapons that had a high probability of kill."[10]

Although Desert Shield and Desert Storm signalled to the world that the nature of warfare was changing, the picture of future combat is still hazy; the changes are far from complete.

One battle continuing is the role of air power. Following the Gulf War, some were quick to conclude that there is a "new era of warfare that air power will dominate."[11] Exhaustive studies of the Gulf War are being completed to see what the results can teach about future conflicts. Eliot A. Cohen, a strategic studies professor at Johns Hopkins University directed the Gulf War air survey. He said that "the study's results do not yet support the contention of some Pentagon theorists that new capabilities in target detection, information processing and radar-evading stealth have ushered in a 'military technological revolution' in which air power will dominate future battlefields."[12] As Rosen tells us, debate over future war is healthy, and can lead to major innovations.

1. Future Trends in the MTR

In 1992, the Pentagon proposed a Defense Science and Technology Strategy that identified seven areas of technological development as being crucial to maintaining America's edge in military technology. The seven areas referred to as science and technology "thrusts" are:

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[10]Ibid.

[11]"Gulf War-Study Points Out Limits of Air Power," Periscope Daily Defense News Capsules, 13 May 1993, WESTLAW 29033640.

[12]Ibid.

-global surveillance and communications;
-precision strike weapons;
-air superiority and air defense systems;
-sea control and undersea systems;
-advanced land warfare systems;
-'synthetic environments' (advanced simulation of future battlefields [so-called virtual reality] for preparation and training); and
-cost reduction technologies.[13]

Research and development are continuing. Despite the transition to the term revolution in military affairs to describe future combat, Defense Secretary William Perry continues his push for the MTR today. Of the seven thrusts mentioned above all affect Navy Department roles and missions. In an updated list of priorities, the Pentagon recently identified the following specific priority areas for future study; stealth technology, precision weapons, and computers and information processing.[14]

2. The Military-Technical Revolution in the U.S. Navy

In 1994, the Naval War College Review published U.S. Naval Reserve Captain John Bodnar's article in which he identifies areas of applicability within the MTR for the U.S. Navy. Bodnar makes the case that the MTR can be divided into three distinct phases:

- a military engineering revolution,
- a military sensor revolution, and
- a military communications revolution.[15]

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[13]Baker Spring and John Luddy, "Keeping America Safe and Strong: A New U.S. Defense Policy," in A Safe and Prosperous America: A U.S. Foreign and Defense Policy Blueprint, ed. Kim R. Holmes (Washington, DC: The Heritage Foundation, 1994), p 68.

[14]"Deutch Gets 'Report Card' Letter on the Revolution in Military Affairs," Inside The Navy, 24 Oct 1994, 11.

[15]Bodnar, 7.

Bodnar states that the military engineering revolution, while perhaps not complete, has reached some tangible, practical limits. For example, ICBM's exist that can reach all corners of the globe, as can manned aircraft. Therefore, he concludes the practical limit on range has been reached. Turning next to limits on speed, Bodnar examined a series of speed related issues; e.g., transport aircraft, combat aircraft, sea transportation, etc. He concludes that the world has reached the practical limit on speed as well.[16] His argument that practical limits have been reached is based on his conclusion that "engineering technologies have pushed materials and human bodies so near their physical limits that new generations of weapons and platforms will be grossly more expensive for marginal gain.[17]"

Bodnar claims that speed limits are becoming apparent in a third field too. Communication also has two practical speed limits--the speed of light in transmission of data, and the speed of thought in the limit of the human brain to absorb information and act on it.

Despite this speed limit, Bodnar postulates that the potential for exploiting the new revolution in military

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[16]Bodnar observes that the practical limit on transport aircraft is the speed of sound. He considers the Concorde and other supersonic transports to be novelties that failed to revolutionize air transport. He argues that the cruise missile maximum speed has been capped also at the speed of sound because of the high fuel usage above that speed. He concludes that fighter aircraft dogfight maneuvering limits are approximately 2 g's--the limit of the man in the airframe. Bodnar reports that the ballistic missile speed limit is 18,000 mph because at higher speeds it will orbit the earth. Because of drag and fuel considerations, he concludes that the sea transport speed limit is approximately 30 knots and the most efficient speed for oil/coal burning vessels is between fifteen and twenty knots. He finds the land transport maximum speed is 55 mph. For an explanation of how he reached his conclusions, see Bodnar, 10-13.

[17]Bodnar, 14.

technology resides in the ability to collect, process, and disseminate information.

> The real revolution of this phase of the MTR in the U.S. military was in the better combat efficiency that arose from the ability of individual platforms to collect, collate, and react to huge quantities of sensor data quickly and effectively, and rapidly launch highly sophisticated and programmable ('smart') weapons.[18]

As the analysis of the Gulf War progresses, lessons are being learned and new aspects of modern warfare are emerging. Many are technology based, e.g., improved communications and information warfare, pilotless vehicles (both air and ground), and smart weapons. Other aspects of the revolution such as, the Navy's new littoral focus are less reliant on technology, but are revolutionary nonetheless. To encompass all of the revolutionary changes taking place (not only the technological changes) the term revolution in military affairs (RMA) is being used.

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[16]Ibid., 16.

IV. THE REVOLUTION IN MILITARY AFFAIRS (RMA)

"Desert Storm represents a revolution in warfare."[1] The words are those of U.S. Air Force General George Horner speaking at the 1994 symposium on New-Era Warfare. The torrent of articles with the same theme suggest that a consensus is forming among military analysts. Why? What was truly revolutionary about Desert Storm? One reason General Horner said was President Bush's priority to minimize casualties; not only for coalition forces and civilians, but for Iraqi troops as well. Describing the Gulf War, Soviet analysts reported, "the nature of modern war has changed radically from what seemed commonplace only a few years ago."[2] They observed increased importance of fire power over maneuver, and marveled at the "associated impact of new technologies in changing the face of battle."[3] But there is more than just new technologies.

Major General Vladimir Slipchenko, a Russian military scientist from the General Staff Academy, drawing on lessons from the Gulf War, offered his vision of future war. He

> began by noting that when advanced-technology weapons are expanded on a large enough scale, as they were in the Gulf, "these weapons will create a new revolution in military affairs. Large groups of military units may not be needed in the future." General Slipchenko added that there would be "no front lines or flanks" in future wars and that enemy territory would instead be divided "into targets and nontargets." War will involve the massive use of technology and will be over quickly, the political structure will destroy

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[1]George Horner, "New-Era Warfare," Washington Roundtable on Science & Public Policy, by the George C. Marshall Institute (Washington, DC: George C. Marshall Institute, 1994).

[2]Benjamin S. Lambeth, Desert Storm and Its Meaning: The View from Moscow, (Santa Monica: RAND Corporation, 1992), 69.

[3]Ibid.

itself, and there will be no need to occupy enemy territory.[4]

The concept of a revolution in military affairs (RMA) is relatively new in the United States. It is replacing the concept of the military-technological revolution (MTR) because the RMA is more inclusive. This chapter introduces the Revolution in Military Affairs (RMA), and summarizes current trends in the RMA as they are relevant to the U.S. Navy.

A. WHY A REVOLUTION IN MILITARY AFFAIRS INSTEAD OF A MILITARY-TECHNICAL REVOLUTION?

Technology is a catalyst to innovation. The availability of new technology enables military planners and dreamers to visualize future warfare using the new hardware and software. But technology alone does not constitute a revolution, and indeed may not be necessary for one to take place. Once again, Soviet writings about revolutions in technology and military affairs reflect a longer history on the subject. In an October 1961 speech to the Twenty-Second Party Congress, Nikita Khrushchev explained that "successes in socialist production and in Soviet science and engineering have allowed us to bring about the present revolution in military affairs."[5] The technology is an enabler in bringing about a revolution in military affairs.

In 1994, America's military leaders concluded that technology alone would not cause a military revolution, and a plethora of articles began appearing about the revolution

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[4]Ibid., 70.

[5]Nikolai Galay, "The Soviet Approach to the Modern Military Revolution," in The Military-Technical Revolution: Its Impact on Strategy and Foreign Policy (New York, Frederick A. Praeger, 1966) John Erickson, ed., quoting from by Krasnava zvezda (Red Star), April 4, 1962.

in military affairs. Admiral Paul David Miller, Commander-in-Chief, U.S. Atlantic Command, wrote

> But the technological multiplier effect, by itself, cannot offset the planned force reductions forecast in the Department of Defense's *Bottom-Up Review.*[6] We need to break with the past and actively explore new ways to provide our joint force commanders with enabling capabilities.[7]

The focus of the RMA is primarily on doctrine, but an important component is technology. The "MTR will develop innovative systems to make doctrinal changes work. Just as the tank was essential to the blitzkrieg, technology will play an enabling role in the RMA."[8] Many analysts believe that much enabling technology is available today.

However emphasis for the future must be ideas, concepts, and doctrine. "The MTR denotes too great an emphasis on *technology*. Therefore, much of the interested community now uses the term Revolution in Military Affairs, which focuses on *revolution*, and clearly places *technology* in a supporting role."[9] U.S. Navy Captain Bradd Hayes who edited the 1994 Naval War College Report, The Politics of Naval Innovation, writes "technical innovation without doctrinal innovation cannot spark an RMA."[10]

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[6]In fact force levels are being cut below the Bottom-Up Review levels.

[7]Paul D. Miller, "The Military After Next: Shaping U.S. Forces for the Next Century," The U.S. Naval Institute Proceedings 120 (February 1994): 42.

[8]"Pentagon Looks at Technology Revolution," Defense & Aerospace Electronics, 11 Nov 1994, WESTLAW, 2707243.

[9]Jeffrey R. Cooper, Another View of the Revolution in Military Affairs, Carlisle Barracks, PA: U.S. Army War College, 1994, 40.

[10]Hayes and Smith, 5.

B. THE CURRENT REVOLUTION IN MILITARY AFFAIRS

In the U.S., one of the first open source references to the "revolution in military affairs" is in Michael MccGuire's 1987 book, Military Objectives in Soviet Foreign Policy. In Military Objectives, MccGuire describes the Soviets' "new political thinking" based upon changes in the world including increased interdependence among nations causing national security to depend more on mutual security. MccGuire, a senior fellow at the Brookings Institution, reported that Soviet doctrine no longer considered escalation of conflict with the West inevitable. He wrote that another concrete factor pushing the Soviets toward 'new thinking' about foreign and defense policy is the impending *revolution in military affairs* being generated by new technologies. The Soviets feared a new arms race, so by admitting the interactive nature of the arms race, they hoped to dampen its effect.[11]

The first public mention of the RMA by the White House was in Vice President Dan Quayle's speech to the 1989 graduating class at the U.S. Military Academy at West Point, NY. Quayle told the graduating cadets that a revolution in military affairs will require "new military organizations and new methods of warfare." The vice president said that he expects a revolution in military affairs over the next 10 to 15 years that will "require us to develop new operational concepts, new military organizations and new methods of warfare."[12] Quayle challenged the graduates to be ready to fight in battles far different from the historical battles that they studied.

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[11]Michael MccGuire, "Military Logic Changes Foreign Policy," Newsday 14 June 1987, 4, WESTLAW.

[12]Danforth Quayle quoted in "Quayle at West Point, Talks of Revolution in Military Affairs," Boston Globe, 25 May 1989, 8, WESTLAW, AA0709;05/24.

In November 1989, William H. Kaufman, of the Brookings Institution, and former advisor to Secretaries of Defense, Robert McNamara and Harold Brown, unveiled his plan to trim the U.S. defense budget by $145 billion over ten years, saying the U.S. should take such action as a result of the revolution in military affairs.[13]

C. WHAT DOES THE REVOLUTION IN MILITARY AFFAIRS FORETELL?

First of all, focusing on the RMA allows U.S. military planners to be proactive. This is an historic opportunity for strategic planners--"It is easier to design a future than it is to predict it."[14] For the United States, the RMA means "information dominance" over opponents. The U.S. plans to have complete information over a 40,000 square mile (200mi. X 200mi.) battle-space.[15]

Analysts are projecting competing views of what the RMA will bring. If the RMA occurs, it will certainly affect contractors as well as the military. One analyst predicts an "increase in efficiency arising from the appearance of tens of thousands of smaller firms, compared to the Fortune 500,"[16] and the military will benefit tremendously from this increased efficiency and competition.

Martin van Creveld writes,

> This [future combat, post RMA] does not mean that technology has no role to play in the military future. What it does mean is a move away from today's large expensive, powerful machines toward small, cheap gadgets capable of being manufactured

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[13]"Ex-Defense Advisor Calls for Budget 'Revolution,'" San Francisco Chronicle, 22 November 1989, A11, WESTLAW.

[14]Paul Bracken in Paul Bracken and Raoul Henri Alcala, Whither the RMA: Two Perspectives on Tomorrow's Army (Carlisle Barracks, PA: U.S. Army War College, 1994), 1.

[15]Ibid.

[16]Ibid, 5.

> in large numbers and used almost anywhere, much as, in the past, firearms replaced the knight and his cumbersome armor."[17]

Other analysts argue that the RMA is doctrine oriented.[18] John Deutch, Deputy Defense Secretary, referred to the RMA as follows,

> As an operative concept describing changes in modern warfare, RMA reduces the emphasis on technology and adds a greater weight to the impact of changes in operational concepts and organizations. The three main components are information warfare, precision strike, and dominant maneuver.[19]

Within the Office of the Secretary of Defense (OSD), RMA has become the lexicon for discussing future war. Five task forces were formed near the end of 1993 at Defense Secretary William Perry's request to study various aspects of the RMA. Late in the fall of 1994, the five task forces were organized into three groups.[20]

The three groups include the task force on "Fostering/Institutionalizing Long Term Innovation," headed by Andrew Marshall, the director of the Pentagon's Office of Net Assessment. Marshall's group which has completed its

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[17]Martin Van Creveld, The Transformation of War (New York: The Free Press, 1991), 210.

[18]Raoul Henri Alcala in Paul Bracken and Raoul Henri Alcala , Whither the RMA: Two Perspectives on Tomorrow's Army (Carlisle Barracks, PA: U.S. Army War College, 1994), 16.

[19]"Deutch Gets 'Report Card' Letter on the Revolution in Military Affairs," Inside the Navy. 24 October 1994, 11.

[20]Initially the five task forces were to report to Secretary Perry in September 1994. As that deadline approached, the groups were reorganized, directed to focus on gaming and modeling to create a vision of future combat, and future combat requirements. The revised reporting deadline is March 1995.

evaluation, and is expected to brief the RMA steering committee early.[21]

The second task force is the theater warfare task force. Their task was to conduct a series of intensive wargames to identify future needs of the military. Their report will address "Combined Arms and Maneuver (co-chaired by Army and Marine Corps officials), Deep Strike (co-chaired by Navy and Air Force officials), and Naval Forward Operations (co-chaired by Marine Corps and Navy officials)."[22]

The third task force, chaired by OSD officials, covers Low Intensity Conflict (LIC). It will brief last, and is expected to cover 14 tasks critical to successful low intensity operations.[23]

At the same time the Pentagon announced the timeframe for the task force reports and briefings, the relationship between the MTR and RMA.

> MTR was used before the RMA effort to describe massive changes in conducting warfare resulting from advances in technology. . . RMA is considered the 'logical outgrowth' of MTR. It refocuses on innovations in operational concepts, doctrine, and organization that are employing new technologies and opportunities. The RMA recognizes dominant maneuver as a key component of warfare and de-emphasizes the impact of technology as the driver in the revolutionary changes in the way wars are fought.[24]

The Pentagon has made RMA a top priority. The Navy is a player. What role will the Navy play? Chapter five will address that question. Navy personnel are assigned to the

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[21]"Deutch Gets 'Report Card' Letter on the Revolution in Military Affairs," Inside the Navy. 24 October 1994, 11.

[22]Ibid.

[23]Ibid.

[24]Ibid.

Pentagon's Office of Net Assessment, the lead office for the task force on Fostering/Institutionalizing Long Term Innovation. As part of their work on the task force, U.S. Navy Commanders James R. Fitzsimonds and Commander Jan M. van Tol, from the Office of Net Assessment in the Office of the Secretary of Defense, wrote an article for the Spring 1994 issue of Joint Forces Quarterly about "Revolutions in Military Affairs"[25] in which they identify three pre-conditions to the full realization of an RMA. The three conditions are:

- Technological Development,
- Doctrinal (or Operational) Innovation, and
- Organizational Adaptation.

It is the Pentagon's view that the technology is available, and doctrine development is underway in all services and at the joint level. The third condition will likely prove the most difficult. Organizational adaptation means bureaucratic acceptance and significant change. According to Fitzsimonds and van Tol, "it is the synergistic effect of these three preconditions that leads to an RMA."[26]

1. Perspectives on RMA prospects

There are few optimists forecasing either a quick or easy time implementing an RMA. One analyst writing about the RMA concluded,

> The formal Defense Department Planning, Programming, and Budgeting System (PPBS), and the day-to-day practices that give it life, have two characteristics that inhibit a true revolution in military affairs. The first is the lack of an institutional, procedural link to joint doctrine.

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[25]James R. Fitzsimonds and Jan M. Van Tol, "Revolutions in Military Affairs," Joint Force Quarterly, 4 (Spring 1994): 25-26.

[26]Ibid., 26.

> The second is the prevalence of threat-oriented marginal analysis.[27]

Retired U.S. Army Colonel Raoul Alcala, writing for the U.S. Army War College, sees "more evolution than revolution in evidence."[28] Alcala is very pessimistic about an RMA anytime soon. In April 1994,[29] he wrote, "revolution in doctrine will be possible only to the extent that significantly different futures concepts or their equivalent drive the process. There are no such revolutionary concepts, service-unique or joint, in existence or under development."[30]

In describing the Russian military--but equally true of U.S. armed forces in the current context--Benjamin S. Lambeth observed that "the military is now adjusting itself from a *threat*-specific to a more *mission*-specific planning environment, in which external challenges have become indeterminate and unavailing of easy standards for deciding on force size and composition."[31]

Remembering Rosen's conclusion that failures in innovation were the result of failure to innovate rather than in choosing inappropriate innovations, it is clear that the U.S. military needs to keep innovating.

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[27]Raoul Alcala in Paul Bracken and Raoul Henri Alcala, Whither the RMA: Two Perspectives on Tomorrow's Army (Carlisle Barracks, PA: U.S. Army War College, 1994), 39.

[28]Ibid., 40.

[29]Alcala wrote this prior to the reorganization of the five RMA task forces, and the emphasis placed on wargaming.

[30]Alcala, 41

[31]Benjamin S. Lambeth, Desert Storm and Its Meaning: The View from Moscow (Santa Monica: RAND Corporation, 1992), vi.

V. ANALYSIS

A. LESSONS FROM THE MODELS

As stated in the introduction, the purpose of this study is to apply lessons and conclusions from models of military innovation to the changes taking place in the Navy today.

1. General Observations

The three models presented in Chapter Two present three different views of how military innovation occurs. First, Davis showed that innovation usually begins with a mid-grade officer who finds a better way of doing something. He enlists the support of peers first, and later he convinces more senior officers to support his project. Usually a counter-alliance emerges. When it does, it usually forms in the more senior ranks. Davis concluded that at this point the successful innovation advocate must become a zealot.

Next, Kurth reported that there are many institutional constraints on innovation in the Navy, but not on efficiency improvements. To enact a major innovation, a maverick zealot is necessary. The institutional constraints described by Kurth are severe enough that Kurth concluded innovation gets stifled unless the zealot develops allies outside the uniformed Navy. The allies are often located in the Congress, White House, or in the Office of the Secretary of Defense.

Finally, Rosen offered multiple models for different conditions. In peacetime, innovation occurs because military men construct a vision of what the next war will be like, envision the pivotal role that innovation will play in winning, and then set in motion the steps to get things

done. Rosen concluded that true innovation occurs when senior officers in positions of power provide a new career path (potentially leading to flag rank) for junior officers to pursue. Without the incentive of a credible career path "blessed" by powerful senior officers, the innovation will not attract quality officers, and the innovation will wither and fade. Rosen also concluded that technological innovation is a special case. He said technological innovation occurred primarily to manage uncertainty. When military officers are faced with uncertain conditions, they look everywhere often turning outwar to find people who can offer solutions.

Although not formally presented in Chapter Two because his model has not been validated by experience in recent naval innovations, Barry Posen's model of innovation imposed from outside the military is considered valid by some scholars, and is used for comparison within the literature.

Recent experiences with revolutionary innovations such as the introduction of cruise missiles and the Aegis combat system into the Navy reveals that no single model explains all cases. More likely, since every innovation is unique, one model may work for a particular innovation, and another for another. Some combination of the models may provide the most accurate generalization, but some specific observations are germane.

Kurth bridges the gap between Posen, who argues that outside intervention is usually required for innovation, and Rosen whose hypothesis holds that innovation occurs when those inside the military have a vision of what the next war will be like and what will be required to win. Kurth wrote "an innovative departure may be pursued in response to a crisis; or the innovator may postulate the crisis to which he offers his proposal as a response."[1]

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[1]Kurth, 381.

CDR Douglas V. Smith, U.S. Navy, co-editor and coauthor of the 1994 Naval War College Report, The Politics of Naval Innovation, referred to what he called the three paradigms--Posen, innovation imposed by outsiders; Rosen, innovation from the top, down; Davis, innovation from bottom, up--and observed that none of the three is

> singularly accurate concerning the manner in which *revolutionary innovation* makes its way into the naval establishment. Rather, the diversity of potential sources of such innovation appears firmly established.[2]

Although no single model successfully explains all innovation, there are still lessons that can be derived. Admiral Kurth proposed some specific measures to foster innovation. Captain Signor also summarized his lessons from the cruise missile case, in a useful form for those interested in current or future innovations.

2. Specific Remedies From the Models

Describing Admiral Rickover's frustration with the system, Kurth wrote, there is a conflict between the system of rotating officers to broaden experiences and the depth of knowledge and sustained effort that innovation demands, particularly at the early stages. His solution--remove the conditions contributing to inertia, and the burden such a system causes to "Navy technological development work"[3] by increasing the emphasis on technical graduate education for naval officers, increasing specialization, and lengthening tours.

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[2]Bradd C., Hayes and Douglas V. Smith, eds., The Politics of Naval Innovation. Strategic Research Department Research Report (4-94. Newport: U.S. Naval War College, 1994), 75.

[3]Kurth, 385.

Kurth seems to favor nurturing the zealot "who can produce results with adequate organizational support, power and funds. Let the leader assemble his own team and attack the problem."[4] Kurth argued that good men know how to find other good men. He favors turning the zealots loose to produce, as unburdened as possible. Where contractors are involved, the process is necessarily more burdensome due to regulation and oversight requirements. The Clinton administration has made it a priority to reduce the regulatory burden on government contracting; however, it is too early to determine the success or failure of such initiatives.

Kurth and the Naval War College group observed that often outside leadership is necessary to protect the zealots from intra-service rivalries. Admiral William Owens, Vice Chairman of the Joint Chiefs of Staff, is trying to encourage true innovation but it is unclear if his efforts will extend to defending innovation zealots as they emerge.

After studying the cruise missile and Aegis combat system cases, Hayes and Smith, et al., concluded "the value of technical competence in Navy program managers cannot be overemphasized." As naval warfare becomes more technical, they argued technical competence becomes even more important than managerial prowess in getting innovations developed. Although this finding is the opposite of what might be expected, technical expertise is essential for dealing with scientists and engineers, and also for dealing with critics, contractors, and Congress. The conclusion of Hayes and Smith, et al., is consistent with Davis' opinion that the innovation advocate possesses specialized technical knowledge that enables him to visualize the innovation.

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[4]Ibid., 388.

[5]Hayes and Smith, 83.

Navy Rear Admiral Wayne Meyer,[6] program manager of the Aegis program, is an excellent example of the type of officer Davis, Hayes and Smith et al., described.

The lessons provided by Captain Signor from his study of the cruise missile program are addressed later in this chapter.

3. Utility of the Models

All the models examined in this study contributed to a better understanding of the innovation process. Each model appears to have accurately characterized the circumstances that they addressed. Applying the models to predict success or failure is a new venture. Rather than applying a model rigidly, the models are more illustrative when more loosely applied.

For example, Davis argued that zealots emerge from middle grade officers who seek to carry out their innovation without seeking allies outside the Navy. At the time that Davis' monograph was written and published, the United States had not yet digested the lessons of the Vietnam War; Congressional oversight and interference with military weapon systems was less rigorous than today. By the time Kurth was writing (just three years later) he concluded that it is absolutely necessary for the zealot to obtain allies outside of the Navy because the Navy lacked the necessary forums to resolve disputes of this type.

Rosen's model seems the most developed, and most useful. His peacetime model fits more cases than any other models considered. The only fault found in Rosen's models is that Rosen may have been too quick to classify military innovators as non-mavericks, or to dismiss their

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[6]Rear Admiral Meyer was a Captain when he was assigned as Aegis program manager.

contributions. Rosen's own model for successful peacetime innovation relies on the actions of officers within the traditional structure of their service to promote the new ideas and methods. Perhaps Kurth and Davis' label--"zealots" may be more palatable to Rosen than "maverick," but it remains that these middle grade innovation advocates made a difference in many case studies, and Rosen appears to ignore the contributions of these middle grade zealots.

Rosen had the benefit of writing a historical description of some of the greatest innovations the world has ever seen. With the benefit of history, Rosen knew that the innovations he chose to examine had been battle-tested and their validity proven. Both carrier aviation and the Marine Corps' amphibious assault doctrine were enormously successful in World War II. They also altered their respective services forever. Rosen could have just as easily chosen innovations that died, or had far less impact.

Rosen leaves it to others to see if his model of peacetime innovation can be applied today. He asserts that the United States focuses too much on a Five-Year Defense Plan, which it calls long term planning. Rosen claims true long-term planning looks twenty to thirty years ahead, the same period Admiral Owens and Andrew Marshall are pushing.[7]

a. Peacetime parallels with today

Rosen observed that the "successful innovations he examined were initiated in periods of constrained resources at least as often as periods during which budgets were large and growing."[8] It is particularly noteworthy that the period in which the U.S. Navy transformed itself from a

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[7]Rosen, Winning, 257.

[8]Rosen, Winning, 57.

battleship navy to an aircraft carrier navy was one in which "naval budgets were modest and constrained by arms control agreements. The United States Marine Corps invented and developed a new form of amphibious warfare during the same period."[9] Rosen draws the conclusion that it is "may be wrong to focus on budgets when trying to understand or promote innovation."[10] Clearly buying huge quantities of hardware to support innovations can be terribly expensive. "But *initiating* an innovation and bringing it to the point where it provides a strategically useful option has been accomplished when money was tight."[11]

All of this points to the fact that the conditions that exist today do not impede innovation. It is not the money that fosters innovation. It is the determination of reform-minded officers within the respected core of their respective services that causes innovation.

B. EFFICIENCY VERSUS INNOVATION

Most of the authors cited in this study tried to distinguish between innovation and finding better or more efficient methods of accomplishing tasks. Webster's defines innovation as "the introduction of something new."[12] Webster's also lists an *archaic* definition for innovate--"to effect a change in . . ."[13] To innovate literally means to create new methods and new ideas. Merely changing the method of doing something, even if the revised method is

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[9]Ibid., 252.

[10]Ibid.

[11]Ibid.

[12]Webster's New Collegiate Dictionary (Springfield, MA: G. & C. Merriam Co., 1979), 590.

[13]Ibid.

more efficient, is not necessarily innovating. Rear Admiral Kurth made a similar distinction between what he termed "incremental innovation" and "innovative departure."[14] To be successful in revolution requires an innovative departure.

Some studies in the literature of naval innovations appear to have included innovations in its archaic sense; the cases they examined were actually examples of increasing efficiency. Of the authors mentioned, the cases examined by Kurth, Posen, Signor and Rosen best illustrate innovation in its true sense. Davis, who wrote first, did not attempt to isolate true innovation from efficiency improvements the way that Kurth and Rosen did.

Since there is a great deal of political opposition to major innovations, Davis and Kurth both observed that some innovators tried to sell their innovation incrementally. Often this was because the "innovation" was actually an efficiency enhancement.

Kurth and Rosen observed the modern military service seems forever intent on increasing efficiency. Continuing efficiency efforts results in evolutionary changes. It takes more than efforts to improve efficiency to result in revolutionary changes.

1. Are today's changes innovations?

For the purposes of this study, the term innovation refers to innovations in the same way Rosen described a major innovation, or the way Kurth described an innovative departure, that is, the revolutionary kind. Hayes and Smith et al., and Signor have chronicled two recent naval

[14]Kurth, 2.

innovations--the introduction of cruise missiles and the Aegis combat system to the fleet[15].

In this era of defense budget cuts, the search for efficiencies endures, but what about newer innovations? Rosen concluded "the task of identifying the need for new military functions and capabilities, however, is very different than the search for military efficiency. Thinking about peacetime military innovation requires a focus on the next twenty to thirty years."[16] Few active duty officers have the luxury of planning that far in advance.

Admiral William Owens, the Vice Chairman of the Joint Chiefs of Staff, and Andrew Marshall, the Director of the Pentagon's Office of Net Assessment are pushing forward thinking. Admiral Owens has revived the Joint Requirements Oversight Committee (JROC), and the services are complaining that Owens is attempting to influence decisions previously thought by the service chiefs to be their own exclusive domain. Owens is engaged in an ongoing battle with the Navy to retire several Oliver Hazard Perry class frigates early (a decision he supported in his previous billet, before his promotion to Vice Chairman of the JCS) and using the savings to fund RMA programs.

Individual services are fighting innovation whenever it gets in the way of funding current forces. "Retired Marine Corps Commandant Al Gray characterized himself as being from the 'evolutionary school, not the revolutionary school.'"[17] Chief of Naval Operations, Admiral Mike Boorda, who opposes the early retirement of the Perry class frigates, also urges an evolutionary pace for change.

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[15]Hayes and Smith et al., wrote about both the introduction of cruise missiles and the Aegis combat system to the fleet. Signor covered the introduction of cruise missiles.

[16]Rosen, 257.

[17]"Pentagon Looks at Technology Revolution," Defense & Aerospace Electronics, 11 Nov 1994, WESTLAW, 2707243.

Andy Marshall said that "the real changes from the RMA will be in military structure and new concepts and operation."[18] However, given institutional resistance, Marshall says the RMA may take as much as 30 years to occur, if it occurs in the U.S. at all.[19]

The pressure to improve efficiency rather than innovate is seductive. A "senior DOD official" quoted in the press, as having spoken only on the condition of anonymity, said that deep strike will be an essential RMA element.[20] As Captain Bognar's Naval War College Review article informed us, we are already reaching the current technological limits of range and speed, so deep strike may be just another efficiency improvement; and it may be a small improvement at that. On the other hand, if the deep strike capability is part of a larger package designed to take the battle away from U.S. forces to limit U.S. losses, then deep strike with precision guided munitions *may* be revolutionary.

The same DOD official then described the DOD's Advanced Research Projects Agency's miniaturization efforts in the fields of computers and sensors. Making computers and sensors smaller does not threaten many jobs. Again, the energy in this part of the RMA is being directed at efficiency improvements.

One area that appears to represent true revolution is the substitution of unmanned vehicles (UVs) in roles where manned platforms are used today. As one can imagine, the aviation community views UVs as a mixed blessing. Aviators welcome UVs such as Tomahawk missiles to attack with precision targets so highly defended that aircraft losses would be extremely high. Just as tank drivers in the Army

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[18]Ibid.

[19]Ibid.

[20]Ibid.

are increasing seeing themselves as targets in the sights of highly lethal precision guided munitions, so to will aviators as extremely lethal anti-air weapons proliferate. Already anti-air missiles can fly significantly faster, and can execute maneuvers that manned aircraft cannot. The man in the loop is becoming the limiting factor. Initially, UVs will likely be used in their traditional role--reconnaissance, but the potential revolution lies in expanding their roles to deliver ordnance on target. Careers in the U.S. Navy have traditionally been built around hardware that need to be manned. UVs still face a difficult path to deployment on a large scale.

C. A NEW DOCTRINE AND A NEW STRATEGY FOR A CHANGING WORLD

The strategy enunciated in *Forward . . . From the Sea* takes the Navy in a new direction--shoreward. To focus on events ashore instead of at sea is major shift for the Navy. It meets Rosen's definition of a major innovation--"a change in one of the primary combat arms of a service in the way it fights or alternatively, as the creation of a new combat arm."[21] The new strategy bumped anti-submarine warfare (ASW) from the top of the Navy's priority list, where it resided for a generation. Already we are seeing dramatic reductions in ASW forces, such as, the P-3 Orion anti-submarine patrol aircraft. Time will tell if today's strategy and resource decisions develop into a long-term focus. If the strategy is sustained over an extended period, career paths should develop soon. Resources and hardware should be put in place to ensure that the new strategy succeeds.

The questions regarding the eventual success of the Navy's new doctrine are difficult to predict. Will the

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[21]Rosen, Winning, 7.

doctrine being drafted by the newly established Naval Doctrine Command (NDC) be revolutionary? Since the Navy has operated so long without formal written doctrine, there are justifiable concerns among naval officers. After all, doctrine affects how we fight, train, exercise, organize, as well as what we buy, and how we plan.

For the doctrine to succeed, it must keep pace with advancing technologies. This is complicated even for established doctrine commands. With NDC in its infancy, it is too soon to tell. The Hayes/Smith group at the Naval War College examined doctrine specifically in their study of naval innovation. Captain Bradd Hayes, U.S. Navy, writes, "if one thing stands out from the cases . . . it is that doctrine invariably lags behind technological innovation."[22] Since the RMA encompasses more than just technological innovations, the resulting doctrine is even more uncertain.

One problem with doctrine is that, by definition, it is stagnant, not innovative. Webster's defines doctrine as, "something that is taught; a principle or position or the body of principles in a branch of knowledge or system of belief--dogma."[23]

Doctrine can drive innovation, but instances are rare. Retired U.S. Navy Commander James Tritten, of the Naval Doctrine Command (NDC) noted,

> in February 1984, the Annual Report to the President and the Congress, Fiscal Year 1985 issued by then-Secretary of Defense Casper W. Weinberger, contained the programmatics for defending the United States with space-based defensive weapons. Since these weapons did not exist, we should not assume that a military doctrine for their employment currently existed."[24]

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[22]Hayes and Smith, 85.

[23]Webster's, 333.

When the decision was made to exploit new technologies permitting a space-based defensive system, it would have been irresponsible for the government not to explore doctrinal issues for their use.

Current and emerging technologies influence military doctrine too. Emerging technology often renders existing doctrine obsolete, e.g., ICBMs, and cruise missiles replacing manned bombers for certain missions. As industry develops new technologies, often it will present ideas to the military who will then consider a doctrine for employment of such systems.[25] As a result of these complications, official naval doctrine will most assuredly lag operations until the Naval Doctrine Command is firmly established, and the vision of the RMA becomes more focused.

D. WHAT CAN THE UNIFORMED MILITARY DO TO FOSTER INNOVATION?

Captain Hayes and Commander Smith of the Naval War College addressed the issue in The Politics of Naval Innovation. They concluded,

> The key to success in future programs would appear to be concentration on technical as opposed to managerial competence in program oversight, creation of a "track" to develop career paths for "mavericks" to ensure they will be rewarded rather than ultimately punished for their dedication to technology competence, and concentration on as near as parallel development of doctrine and technology as can possibly be achieved.[26]

Another tact is to encourage thinking about the Revolution in Military Affairs. In the summer of 1994, the

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[24]James J. Tritten, "Naval Perspective For Military Doctrine Development" unpublished paper, May 1994, 7-8.

[25]Ibid., 10-11.

[26]Hayes and Smith, 85.

Office of the Secretary of Defense (Net Assessment) and the National Defense University Foundation co-sponsored the first annual essay contest to encourage thinking on the RMA among junior officers (Major/Lieutenant Commander and below). Winners will have their essays published in Joint Force Quarterly.

1. Captain Signor's Lessons

Captain Signor provided succinct "lessons for the future" in his June 1994 paper, "Cruise Missiles for the U.S. Navy: an Exemplar of Innovation in a Military Organization."[27] First, "anticipate dissent. It is rare time when members of a large organization share a common vision of the future."[28] In addition to warning military officers to expect dissent, Captain Signor warns, "it would be wise not to stake the Navy's future on any one vision of the future or any particular weapon system."[29]

Next, Captain Signor points out that innovation takes time. In the cruise missile case that he studied, the concept of an "aerial torpedo was on the drawing board in 1917, and it took until 1967 for Harpoon to fly. Patience is a virtue.[30]

Third, Captain Signor recommends that resources for innovation be stabilized; it smooths the process. The cruise missile program suffered by a "feast or famine" funding environment.[31]

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[27]Philip W. Signor, Cruise Missiles for the U.S. Navy: An Exemplar of Innovation in a Military Organization (Newport: U.S. Naval War College, 1994), 97.

[28]Ibid.

[29]Ibid., 98.

[30]Ibid., 99-100.

[31]Ibid., 100.

Next, he cautions, Be prepared for failure. In the cruise missile history he studied, there were more than ten cruise missile projects that never produced a weapon suitable for deployment.[32]

Fifth, Captain Signor repeats a lesson that, Kurth and others discovered--the zealots need protection. Captain Signor suggests active commitment through vertical alliances, "or, at a minimum, a studied neutrality, ensuring that all parties to a professional controversy are treated fairly.[33]

Lastly, Captain Signor suggests that naval leaders "avoid organizational myopia," use foresight to consider the future nature of war, and future roles and missions.[34]

Captain Signor has partially answered the question of whether future innovations will succeed by addressing what should be done by naval leaders to foster innovation. Captain Signor's solution meshes remarkably well with the findings of Davis, Kurth and Rosen.

2. Timing of Innovations

Thus far, this paper has addressed the innovation process, the military technological revolution that may enable a revolution in military affairs. How does it all fit together? Timing is critical. The wrong innovation at the wrong time is a waste of precious resources. Signor wrote, "innovation is successful when technology, together with tactics, operational art, strategy necessary to employ

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[32]Ibid.

[33]Ibid., 101-102.

[34]Ibid., 102

the new technology, is available to the operating forces at the time it is needed: not too early, not too late."[35]

[35]Signor, 89-90.

VI. CONCLUSIONS

> The unresisting progress of mankind causes continual change in the weapons, and with that must come a continual change in the manner of fighting.
>
> A. T. Mahan

Military innovation is being driven and encouraged by many of today's civilian and military leaders. The Pentagon has recently appointed a task force on "Fostering/Institutionalizing Long Term Innovation." Guidance and direction are being provided from the top, but the outcome is uncertain. The fact that a task force on institutionalizing innovation had to be appointed is evidence of the difficulties involved in innovation.

Several models exist that seek to explain how military innovation occurs. No single model tells us how to innovate, although Steven Rosen's model appears to be the most consistent with recent innovative experiences. Although the models vary a certain degree of consensus does exist.

The consensus view is well represented by Naval Reserve Captain Philip Signor, who gives us the lessons for future innovative success. First, anticipate dissent, because a large organization will have differing views of future conflict. Second, innovation is often a time consuming process. Third, the process is not smooth; expect peaks and valleys. Fourth, zealots are necessary for true innovation, and they require protection. Lastly, think big--avoid organizational myopia.

The innovation process can be enhanced by a better understanding of the politics involved. Military organizations seem willing to innovate so long as it does not disrupt anything, but true innovation is bound to be disruptive.

Since the end of the Cold War, the U.S. Navy has embraced a revolutionary strategy. It is too early to tell whether the innovation in strategy will result in a revolutionary doctrine. No other changes undertaken in the last several years are a as monumental as those cited by Rosen, however, there are innovations being contemplated such as, unmanned aircraft taking over some manned-aircraft missions, which could have as broad impact as the Navy's decision to integrate aviation before World War II.

What lies ahead? That depends on the success of contemplated innovations. If the Navy's current littoral focus proves to be more than a passing trend, the Navy must focus resources, and ensure a viable career path exists for junior officers to succeed in the new field of littoral warfare.

Will the RMA succeed? As with all innovation, success or failure depends on the emergence of advocates or zealots who will push their innovation in the face of huge opposition, and even when their own careers are threatened. Andrew Marshall says,

> the big difference between the winners and the losers is not in the technologies they have, but some guys got the right idea. They made the organizational changes, and did the right kind of training, to get a tremendous advantage over those who did not.[1]

If the Revolution in Military Affairs occurs, what are the possibilities? A battle environment with near real-time, near-perfect knowledge available to commanders; perhaps a new generation of cheap, smart, stealthy, missiles e.g., "Super Tomahawks," that will do much of the shore

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[1]Andrew Marshall quoted in Robert Holzer and Stephen C. LaSueur, "A Revolution on War Tactics: Pentagon Gathers Ideas For Future Battlefields," Navy Times, 13 June 1994, AOL.

bombardment job better and more cheaply than aircraft; wings of stealth aircraft protecting fleets and ground forces.

It is difficult to find zealots for new concepts, systems, and ideas that compete directly with a major mission of one of the Navy's three "unions." Perhaps the efforts of Admiral Owens and Andrew Marshall will dull the resistance to innovation, and/or help create and embolden potential zealots.

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